Harsh **Sinha**

• MEMBER OF TECHNICAL STAFF • THOUGHTSPOT •

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Education _____

Indian Institute of Technology, Kanpur (IIT Kanpur) *July 2014—May 2019*
B.TECH IN AEROSPACE ENGINEERING, WITH A SECOND MAJOR IN ELECTRICAL ENGINEERING

GRSS Vidya Mandir, Bhagalpur, Bihar *April 2007—July 2013*
CENTRAL BOARD OF SECONDARY EDUCATION

Publications _____

PUBLISHED

Convolutional Neural Network based Sensors for Mobile Robot Relocalization | [⬈ PDF] [⬈ IEEE]
ACCEPTED AT **IEEE MMAR 2018, MIĘDZYZDROJE, POLAND**
Harsh Sinha, Jay Patrikar, Eeshan Dhekane, Gaurav Pandey, Mangal Kothari

Vision based Autonomous Tracking and Landing of a Fully Actuated Rotorcraft | [⬈ PDF] [⬈ VIDEO]
ACCEPTED IN **CONTROL ENGINEERING PRACTICE, AN ELSEVIER JOURNAL**
Mahathi T Bhargavapuri, Animesh Kumar Shastry, **Harsh Sinha**, Soumya Ranjan Sahoo, Mangal Kothari

Autonomous Detection & Tracking of High-Speed Ground Vehicle using a Quadrotor | [⬈ PDF] [⬈ IEEE]
ACCEPTED AT **AIAA SCITECH FORUM AND EXPOSITION 2019**
Animesh Kumar Shastry, **Harsh Sinha**, Mangal Kothari

Experience & Relevant Projects _____

Drone Swarm Development for Humanitarian Assistance and Disaster Relief *Oct 2018 — May 2019*
WITH DR. M. KOTHARI, DR. ABHISHEK, DR. V. P. NAMBOODIRI, DR. K. RAJAWAT, AND DR. S. R. SAHOO *IIT Kanpur*
- Worked on development of a drone swarm as the first response for Humanitarian Assistance and Disaster Relief operations.
- Developed the complete software stack for an outdoor swarm of VTOL vehicles, with dynamic swarm-schemes and swarm-size.

Intelligent Ground Vehicle | [⬈ REPORT] [⬈ CODE] [⬈ WEBSITE] *Nov 2016—June 2019*
TEAM LEADER UNDER MENTORSHIP OF PROF. GAURAV PANDEY AND PROF. MANGAL KOTHARI
AUVSI IGVC, IIT Kanpur
COURSE PROJECT PROBABILISTIC MOBILE ROBOTICS | [⬈ REPORT]
- Developed a fully autonomous vehicle for waypoint navigaiton, obstacle avoidance and lane driving on challenging terrain.
- Created the stack for Computer Vision, Sensor Fusion, SLAM, Motion Planning and Control and now mentor a team of 20 students.

Deep Reinforcement Learning for Optimal Navigation of a Visually Guided UAV *May 2018—Dec 2018*
SUMMER INTERN PROJECT WITH PROF. FARSHAD KHORRAMI, DR. PRASHANT KRISHNAMURTHY AND NAMAN PATEL *CRR Lab, NYU Tandon*
- Developed a modular framework for Deep RL for UAVs using ROS, Gazebo Sim, Visual SLAM and a custom RL training module.

CNN-based Sensors for Mobile Robot Relocalization | [⬈ REPORT] [⬈ SLIDES] *May 2017—Sep 2017*
WITH PROF. GAURAV PANDEY, PROF. MANGAL KOTHARI, JAY PATRIKAR AND EESHAN DHEKANE *IIT Kanpur*
- Proposed a novel, robust and real-time Convolutional Neural Network based algorithm for Mobile Robot Relocalization.
- Integrated Pose Estimation from RGB Images with Extended Kalman Filter using the ROS-Caffe Platform.

Vision based Autonomous Tracking and Landing on Moving Platforms | [⬈ PAPER] *March 2018—Sep 2018*
WITH PROF. MANGAL KOTHARI, PROF. SOUMYA RANJAN SAHOO, MAHATHI T.B. AND ANIMESH K. SHASTRY *IIT Kanpur*
- Developed a novel method to tracking of and landing on vehicles moving at high speeds using only vision based relative positioning.
- Proposed a novel high performance Adaptive Controller for motion estimation and showed performance in real-world upto 20 kmph.

Human Tracking and Following Quadrotor | [⧉ REPORT] [⧉ CODE]   *Jan 2018—April 2018*
COURSE PROJECT WITH PROF. MANGAL KOTHARI AND SHUBH GUPTA   *IIT Kanpur*
- Developed a pipeline for Human Tracking and Following Quadrotor using Tensorflow API's implementation of SSD Mobilenet.
- Used Kernelized Correlation Filter, Stereo Image Disparity maps and Extended Kalman Filter for better tracking performance.

Low cost Tracking and Landing system for Quads | [⧉ REPORT] [⧉ SLIDES] [⧉ CODE] *Aug 2017—Nov 2017*
UNDERGRADUATE PROJECT UNDER PROF. MANGAL KOTHARI   *IIT Kanpur*
- Developed a solution for tracking a ball of known size on a low-cost low-power processor (Odroid XU4) for light quadrotors.
- Implemented a velocity field-based method for landing and created a custom low-cost Gimbal using Aruino Nano.

Single Image Super Resolution through Sparse Representation | [⧉ REPORT]   *Jan 2018—April 2018*
COURSE PROJECT UNDER PROF. TANAYA GUHA   *IIT Kanpur*
- Implemented and Compared various papers for Single Image Super Resolution with Dictionary Learning in Wavelet domain.
- Proposed a simple Convolutional Neural Network based method for Single Image Super Resolution in Wavelet Domain.

Warehouse Inventory Check using Quadrotors | [⧉ SLIDES] [⧉ CODE]   *Oct 2017—Dec 2017*
WITH PROF. MANGAL KOTHARI, KRISHNARAJ GAUR AND JAY PATRIKAR   *IIT Kanpur*
- Developed a solution for tracking a ball of known size on a low-cost low-power processor (Odroid XU4) for light quadrotors.
- Implemented a velocity field-based method for landing and created a custom low-cost Gimbal using Aruino Nano.

Quazar Oscillation Control Card for Scanning Tunnelling and Atomic Force Microscopy *May 2016—July 2016*
SUMMER INTERNSHIP AT QUAZAR TECHNOLOGIES, UNDER JOSHUA MATTHEWS, UNIT HEAD, PROBE MICROSCOPY *Quazar, Delhi*
- Designed oscillation control electronics, Hardware PID Controller and Phase Locked Loop system for scanning probe of an AFM.
- Designed the PCB, Implemented the drivers and tested the functioning with an AFM on Carbon Nano Tubes and Gold deposit.

Wind Propelled Navigation and Pole-climbing Robots | [⧉ POSTER] [⧉ WEB] [⧉ VIDEO] *Sep 2015—March 2016*
PROJECT UNDER PROF. BHASKAR DAS GUPTA AND DR. ANJALI KULKARNI   *ABU Robocon'16, IIT Kanpur*
- Developed the Electronics for a pair of Semi-Autonomous Robots for Collaborative Line, Wall-following and Pole Climbing.
- Designed and Coded systems for Wall-following, Propeller Speed Control and implemented a Kalman Filter for Odometry estimation.

Artificial Intelligence for Factories of Future | [⧉ SLIDES] [⧉ VIDEO]   *Aug 2017—Jan 2018*
WITH ANIMESH SHASTRY AND EESHAN DHEKANE   *IIT Kanpur*
- Proposed Solutions for Challenges proposed by HUL, with focus on Human/Vehicle Tracking and Warehouse Management.
- Winner of IIT Kanpur round with a funding of INR 50,000 for deployment of proposed solutions in HUL factories.

Satellite Image Segmentation using Deep Learning | [⧉ SLIDES]   *Dec 2018*
WITH APURV GUPTA AND HARISH RAJAGOPAL   *IIT Kanpur*
- Developed a per-class UNet based solution for multi-class segmentation of Satellite Images and achieved accuracy around 90%.

Autonomous Underwater Vehicle | [⧉ WEBSITE]   *Dec 2014—Aug 2015*
PROJECT UNDER PROF. K S VENKATESH   *IIT Kanpur*
- Developed Motherboard and Drive-system PCB design and Localization using Inertial Measurement Unit (IMU).

Technical Skills

Programming	C/C++ • Python • Bash • Matlab / GNU Octave • LaTeX
Computer Vision	OpenCV • Pillow • Pytorch • Sklearn
Electronics	gEDA • pcb • Altium • Eagle • Arduino • PixHawk • SPICE Simulator • MicroCap
Software Packages	ROS • Gazebo • Microsoft AirSim • Solidworks • AutoCAD

Achievements & Honors

2019	**2nd & 3rd, International**, Overall & AutoNav, 27th Intelligent Ground Vehicle Challenge	Michigan, USA
2019	**4th, International**, Cyber Security in Autonomous Vehicles, 27th Intelligent Ground Vehicle Challenge	Michigan, USA
2018	**Silver Medal, National**, Satellite Imgae Segmentation, InterIIT TechMeet	IIT Bombay, India
2018	**5th & 12th, International**, Robot Design & Overall, 26th Intelligent Ground Vehicle Challenge	Michigan, U.S.A
2018	**2nd, National**, Hindustan Unilever Limited, TechSpark Competition	Mumbai, India
2017	**Bronze Medal, National**, Warehouse Inventory Check, InterIIT TechMeet	IIT Madras, India
2016	**3rd, National**, Asia Broadcasting Union, Robocon 2016	Pune, India